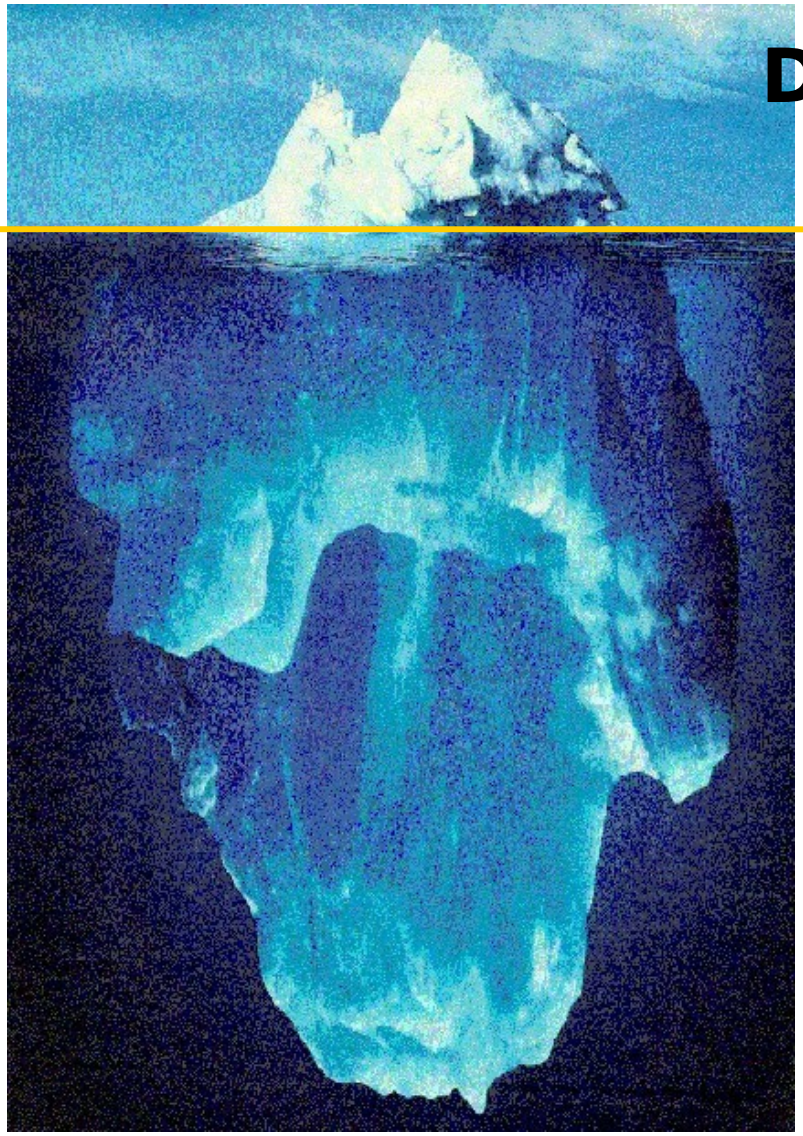
HFACS

The Human Factors Analysis and Classification System

Costs of Naval Accidents



Direct Costs (FY__-__)
$000, ___ Lives

Indirect Costs

- **Loss of Manpower**
- **Delay in Doing Business**
- **Corporate Reputation**
- **Investigation Costs**
- **Litigation**

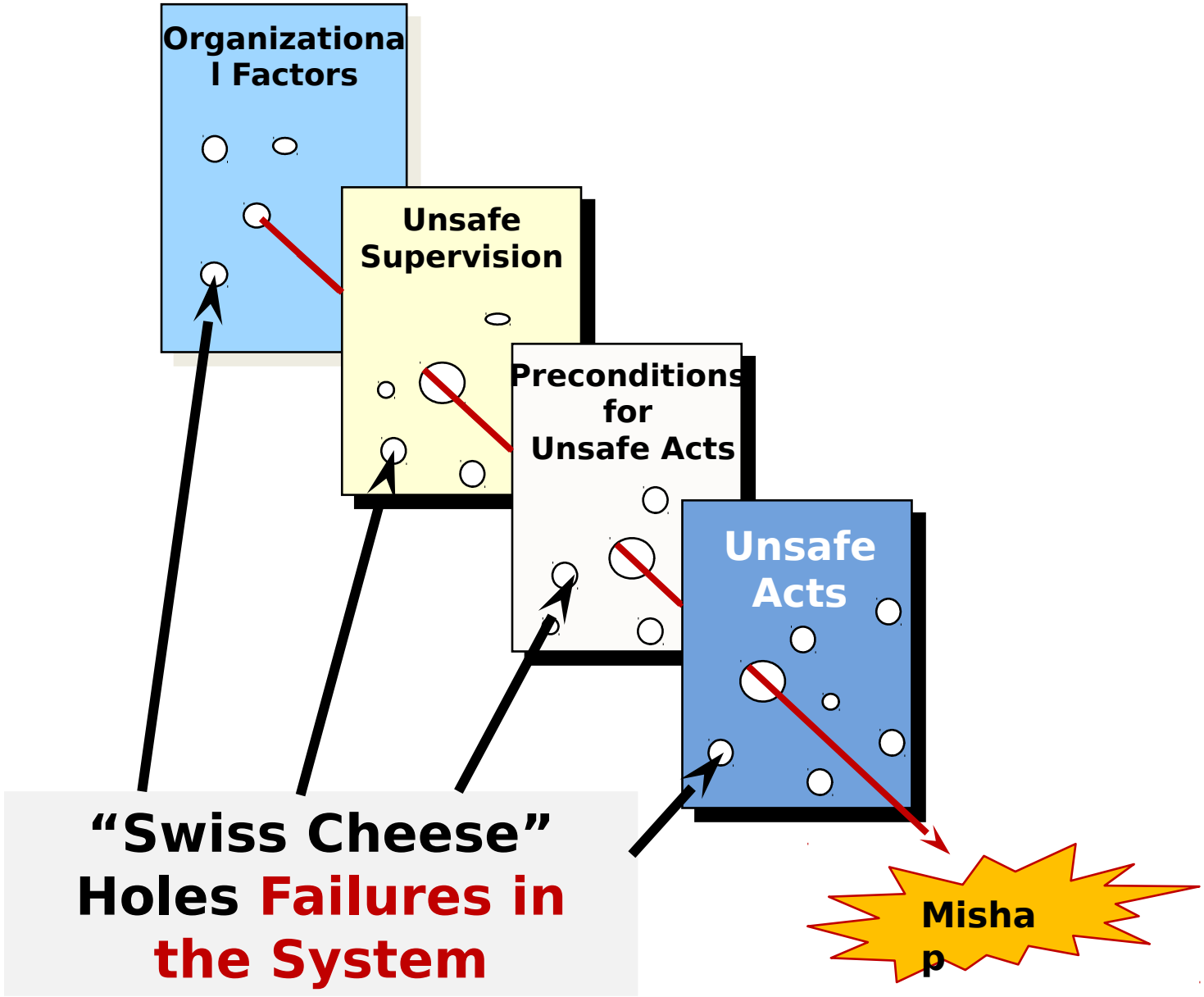
Origins of DoD HFACS

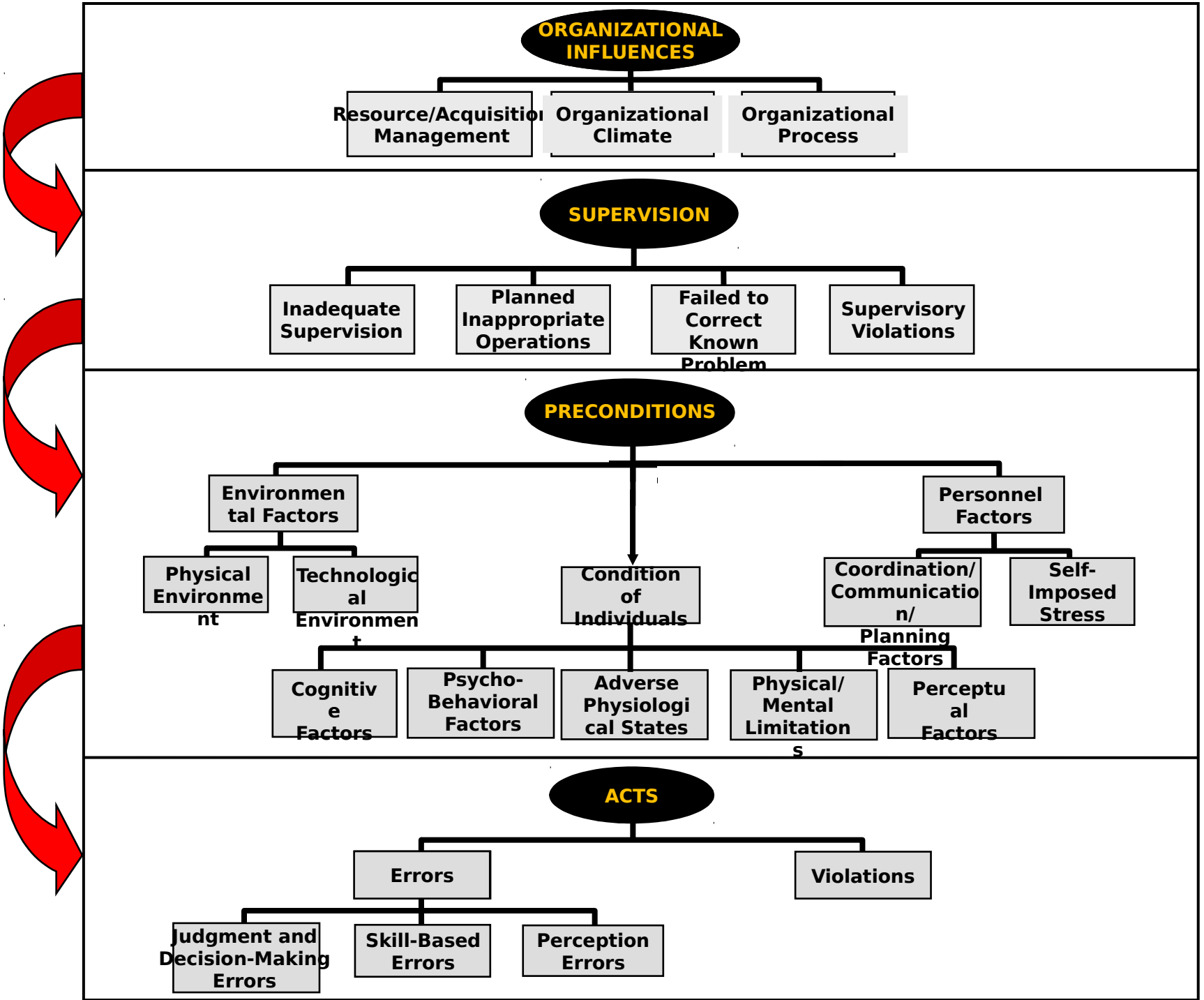
- Starts with James Reason's "Swiss Cheese" model
- Based on Human Factors Analysis and Classification System (HFACS) by Doug Weigmann & Scott Shappell
- Categorizes latent and active failures in complex systems

Origins of DoD HFACS, cont.

- Brings together human factors, operations, human systems, systems safety and engineering issues
- Philosophy of mishap analysis that focuses on the system instead of the individual
  - Original version used by USN as mishap analysis tool
- DoD-HFACS is the follow-on product

Reason's Model of Human Error




ORGANIZATIONAL INFLUENCES
Resource/Acquisition Management
Organizational Climate
Organizational Process
SUPERVISION
Inadequate Supervision
Planned Inappropriate Operations
Failed to Correct Known Problem
Supervisory Violations
PRECONDITIONS
Environmental Factors
Physical Environment
Technological Environment
Condition of Individuals
Personnel Factors
Coordination/ Communication/ Planning Factors
Self-Imposed Stress
Cognitive Factors
Psycho-Behavioral Factors
Adverse Physiological States
Physical/ Mental Limitations
Perceptual Factors
ACTS
Errors
Violations
Judgment and Decision-Making Errors
Skill-Based Errors
Perception Errors

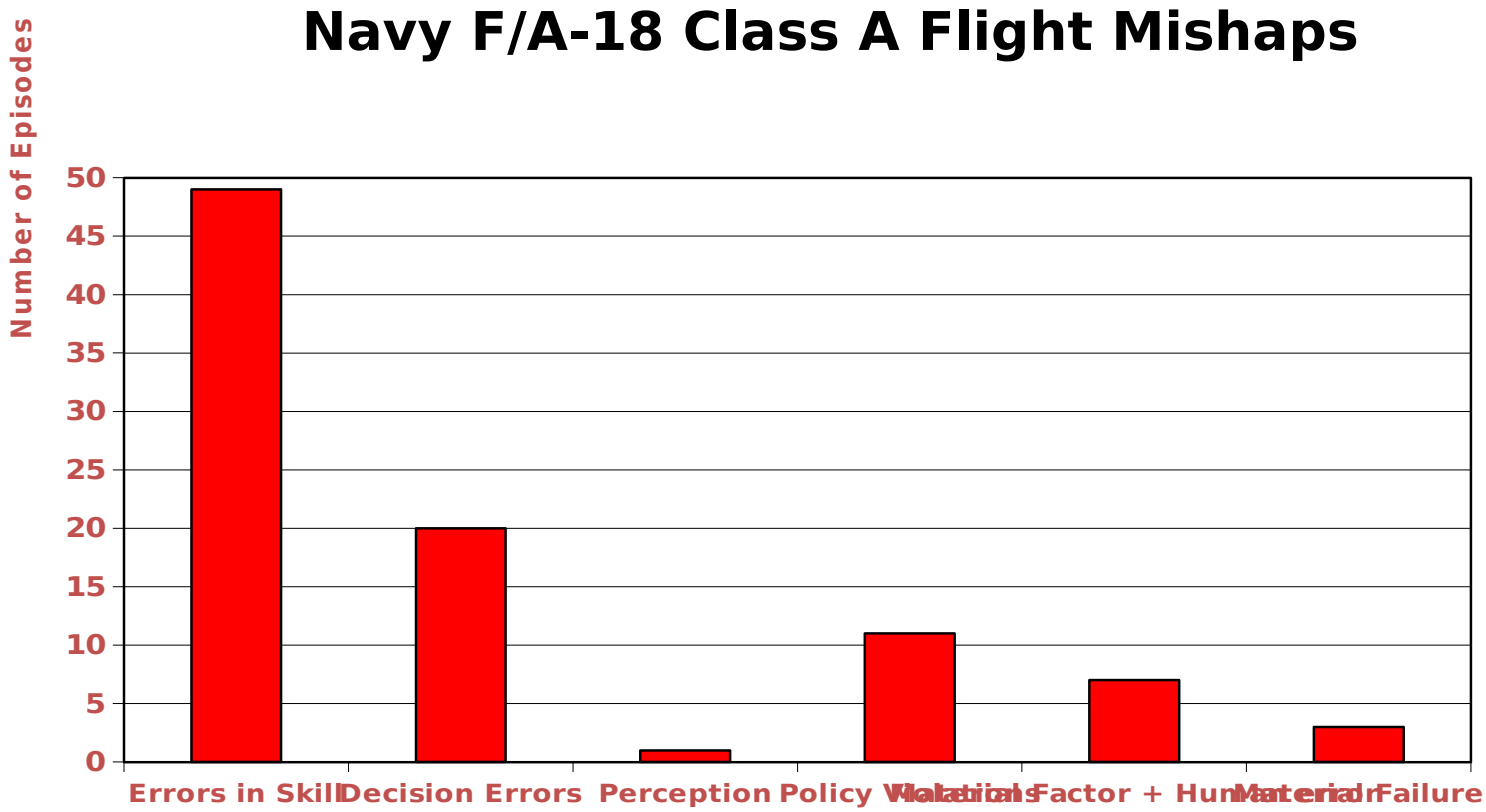
Think decision tree

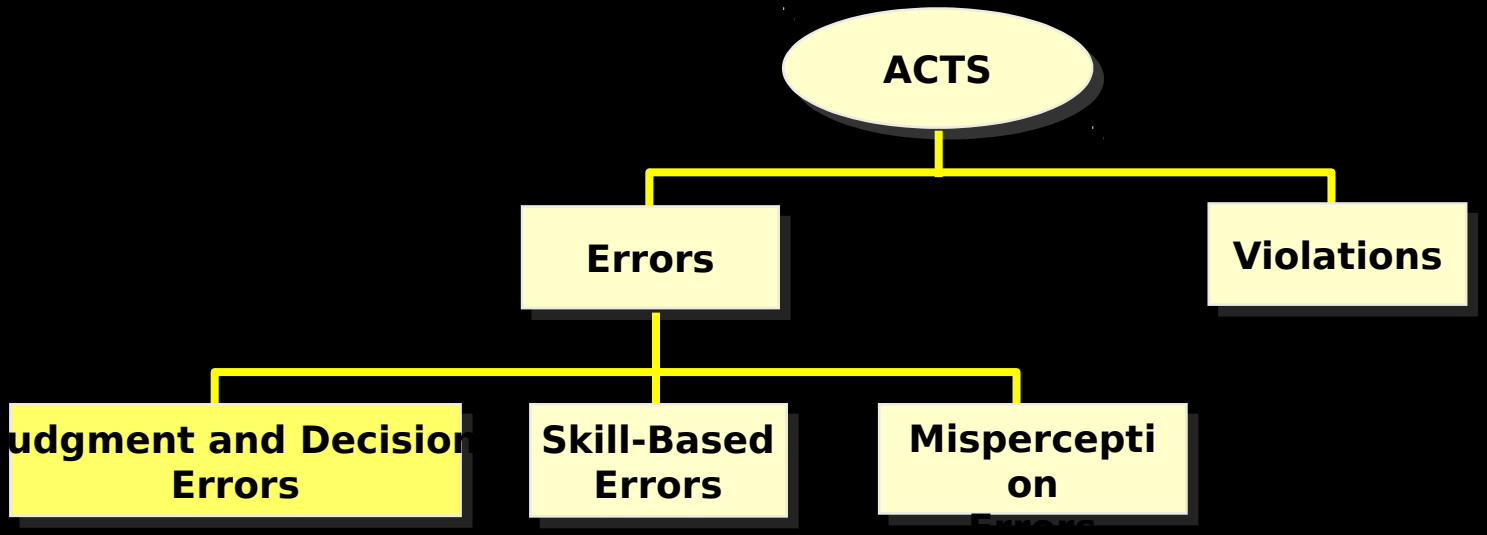
- Analysis starts with end result
- Traces back through the “decisions” and conditions
- Layers of Swiss cheese are conditions at each level
- Some cheese has more holes than others
  - Poor command climate, not enforcing rules
  - Personnel fatigued or poorly trained
  - Some environments more challenging

Goal: More “solid cheese” -- Countermeasures to avoid the holes

Why?

To reduce mishap rate, efforts must focus on identifying the primary causes, which in most cases is the human.




ACTS
Errors
Violations
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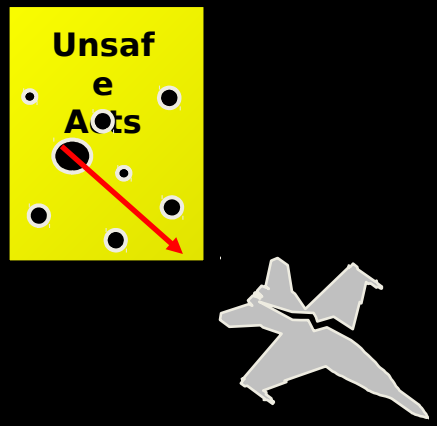
Skill-Based Errors
Mispercepti on


Unsaf e Acts

ACTS

Errors

Violations

Judgment and Decision Errors

Skill-Based Errors

Mispercepti on

DECISION ERRORS

- Risk Assessment – During Operation
- Task Misprioritization
- Necessary Action – Rushed
- Necessary Action – Delayed
- Caution/Warning – Ignored
- Wrong choice of action

ACTS

Errors

Violations

udgment and Decision Errors

Skill-Based Errors

Mispercepti on

SKILL-BASED ERRORS

- Inadvertent Operation
- Checklist Error
- Procedural Error
- Overcontrol/Undercontrol
- Breakdown in Visual Scan
- Inadequate Anti-G Straining Maneuver

ACTS

Errors

Violations

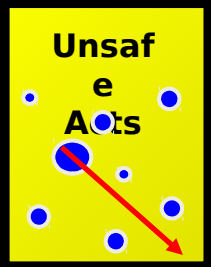
udgment and Decision Errors

Skill-Based Errors

Mispercepti on Errors

MISPERCEPTION ERRORS
(due to)

- Misjudge Distance, Altitude, Airspeed
- Spatial Disorientation
- Visual Illusions



ACTS

Errors

Violations

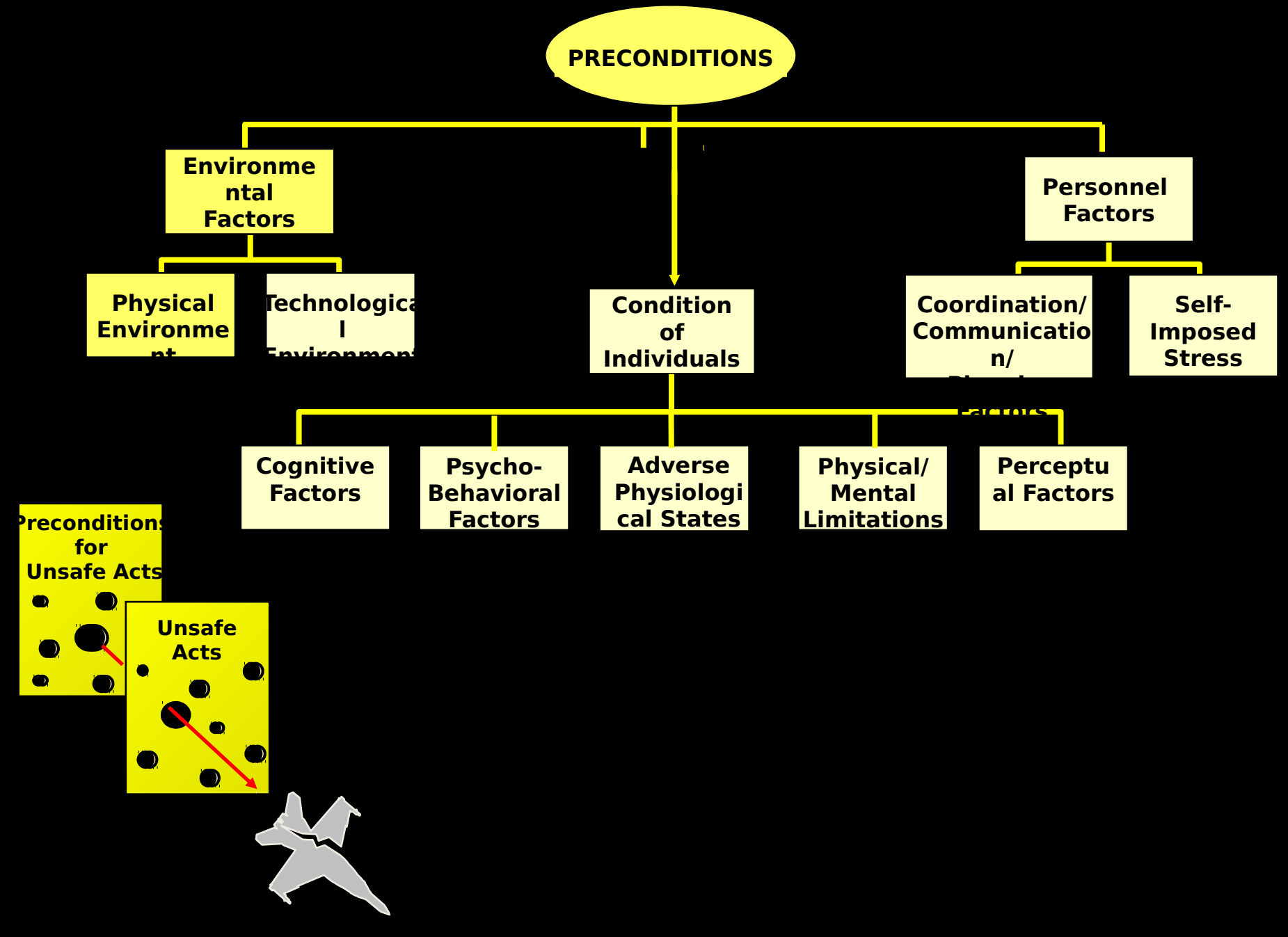
udgment and Decision Errors

Skil E

VIOLATIONS

(Willful disregard for rules and instructions!)

- Violation – Work-around
- Violation – Routine/Widespread
- Violation – Extreme


PRECONDITIONS
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Physical Environment
Technological Environment
Condition of Individuals
Personnel Factors
Coordination/ Communication/
Self-Imposed Stress
Cognitive Factors
Psycho-Behavioral Factors
Adverse Physiological States
Physical/ Mental Limitations
Perceptual Factors
Preconditions for Unsafe Acts
Unsafe Acts

Acts

The act is the end result. It answers the question of, “what happened?”

- Skill-based Errors: errors in regularly-performed tasks
- Decision Errors: selection of an incorrect course of action for a particular situation
- Perception Errors: perception of an illusion leads to an incorrect course of action
- Violation: intentionally acting against written policy or procedures.

Preconditions

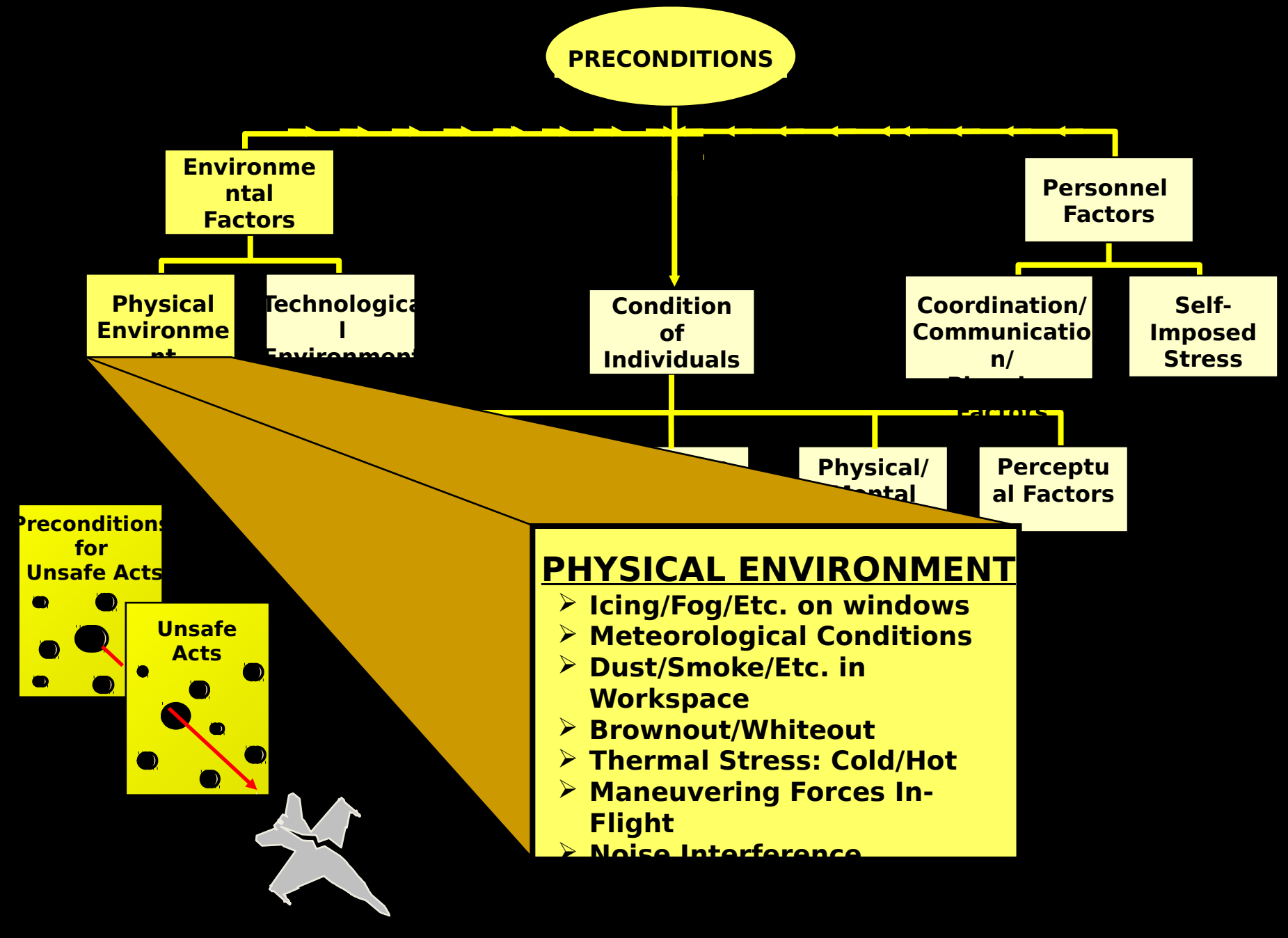
- Physical environment: the working environment. Rain, darkness, cold, hot, etc.
- Technological Environment: the tools used in the mission. Vehicle design and usability of associated systems
- Self-imposed stress: things we do to ourselves – alcohol, lack of sleep, fitness level

Preconditions (cont.)

- Coordination, communication, planning: team interaction, mission planning (CRM)
- Cognitive factors: situational awareness
- Physical/mental limitations: operator size incompatible with workspace, trouble retaining information

Preconditions (cont.)

- Perceptual factors: visual or proprioceptive illusions
- Psycho-behavioral factors: personality problems, overconfidence, aggressiveness, etc.
- Adverse Physiological States: fatigue, effects of medications, breathing difficulties
- **There may be more than one precondition for each act!**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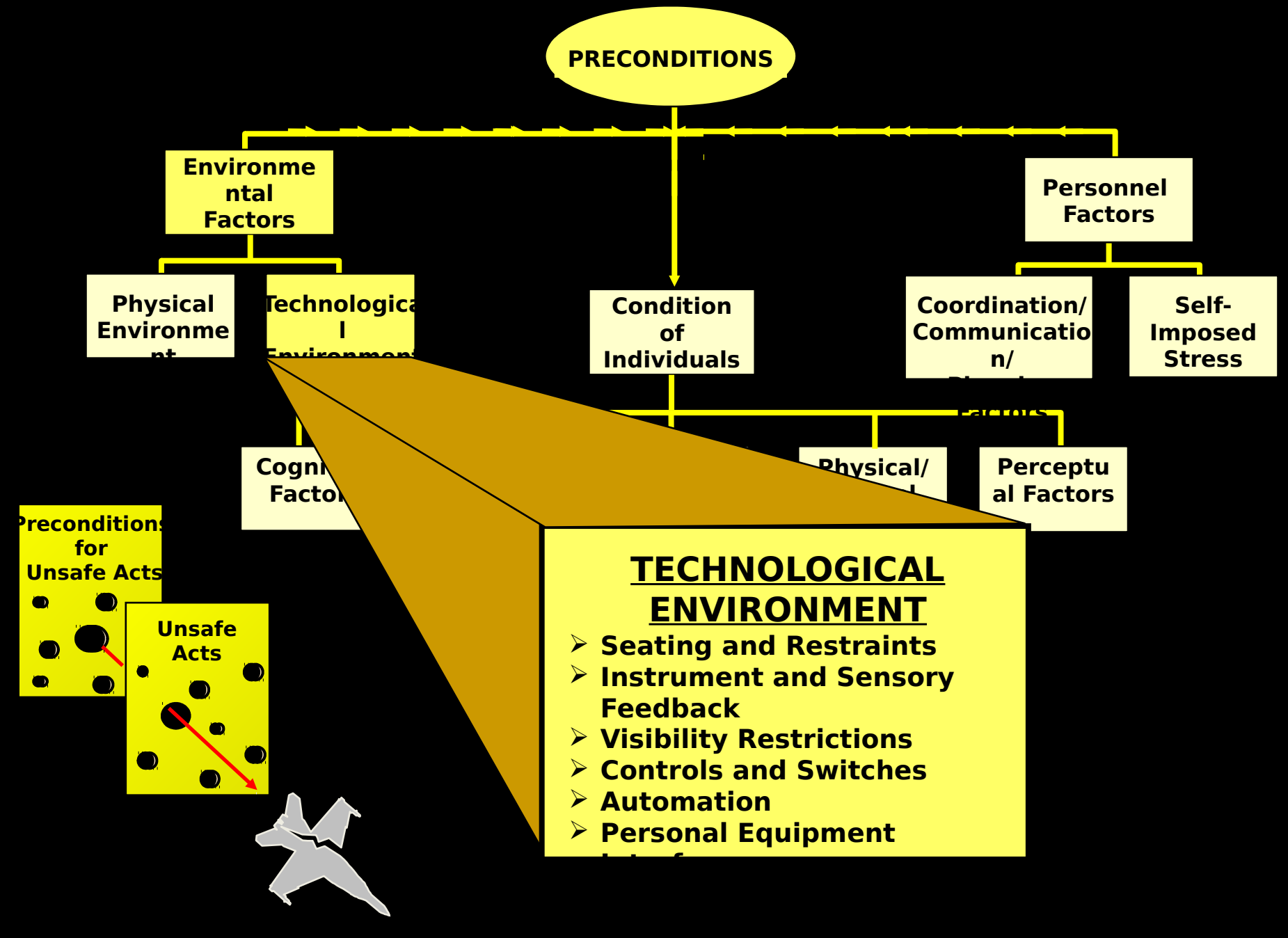
Perceptual Factors
Preconditions for Unsafe Acts
Unsafe Acts
PHYSICAL ENVIRONMENT
Icing/Fog/Etc. on windows
Meteorological Conditions
Dust/Smoke/Etc. in Workspace
Brownout/Whiteout
Thermal Stress: Cold/Hot
Maneuvering Forces In-Flight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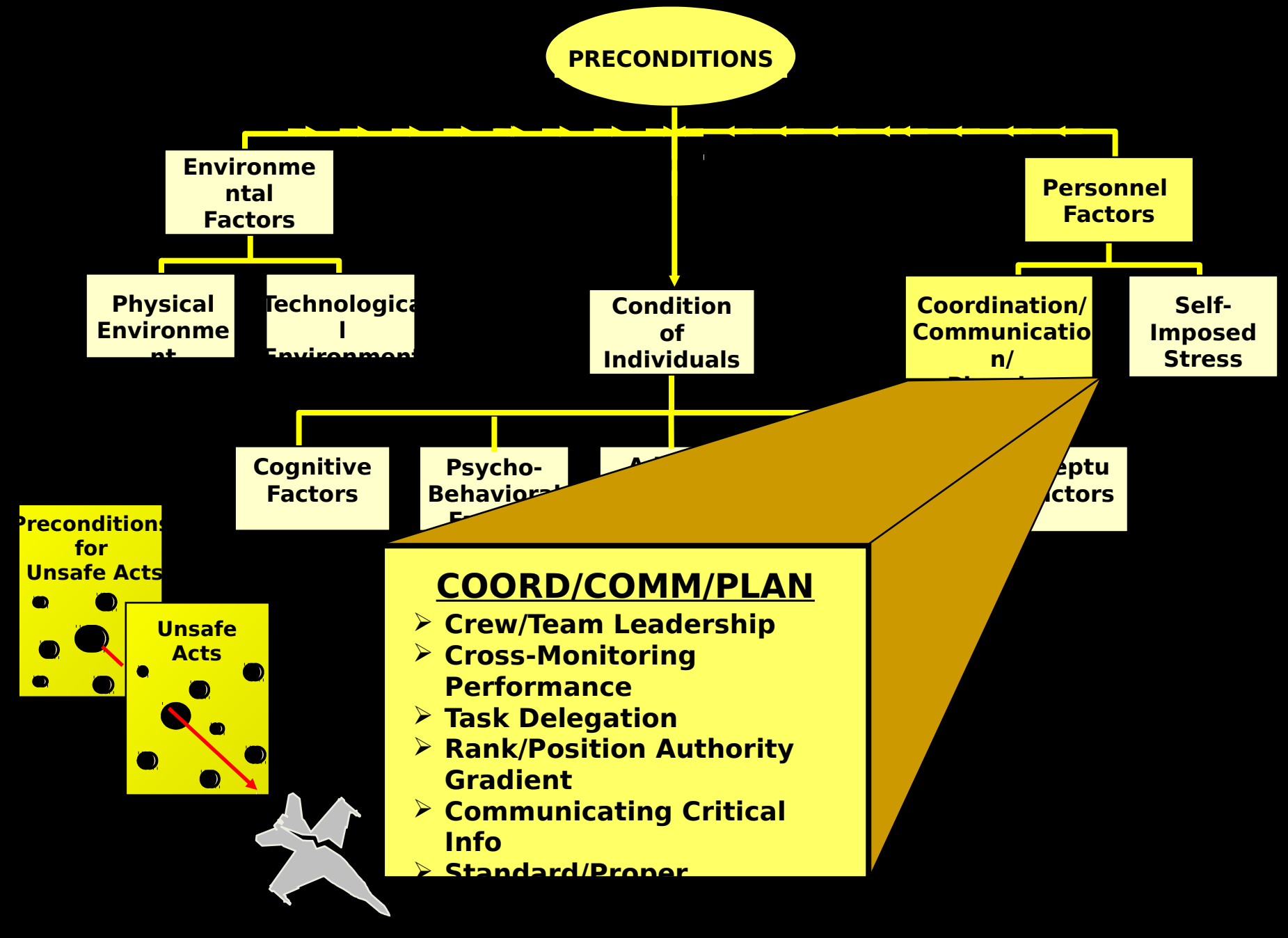
Unsafe Acts
TECHNOLOGICAL ENVIRONMENT
Seating and Restraints
Instrument and Sensory Feedback
Visibility Restrictions
Controls and Switches
Automation
Personal Equipment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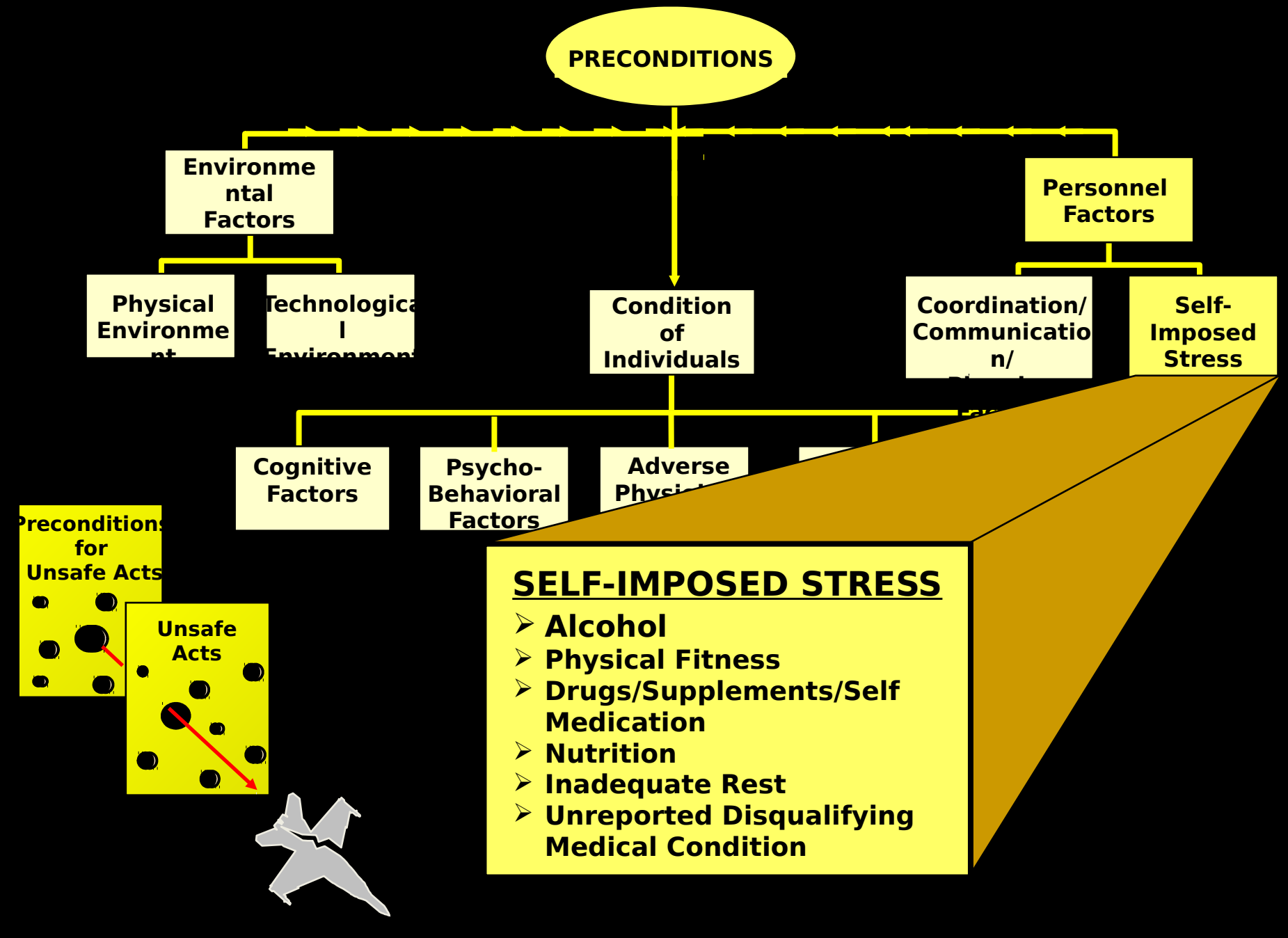
Unsafe Acts
COORD/COMM/PLAN
Crew/Team Leadership
Cross-Monitoring Performance
Task Delegation
Rank/Position Authority Gradient
Communicating Critical Info
Standard/Proper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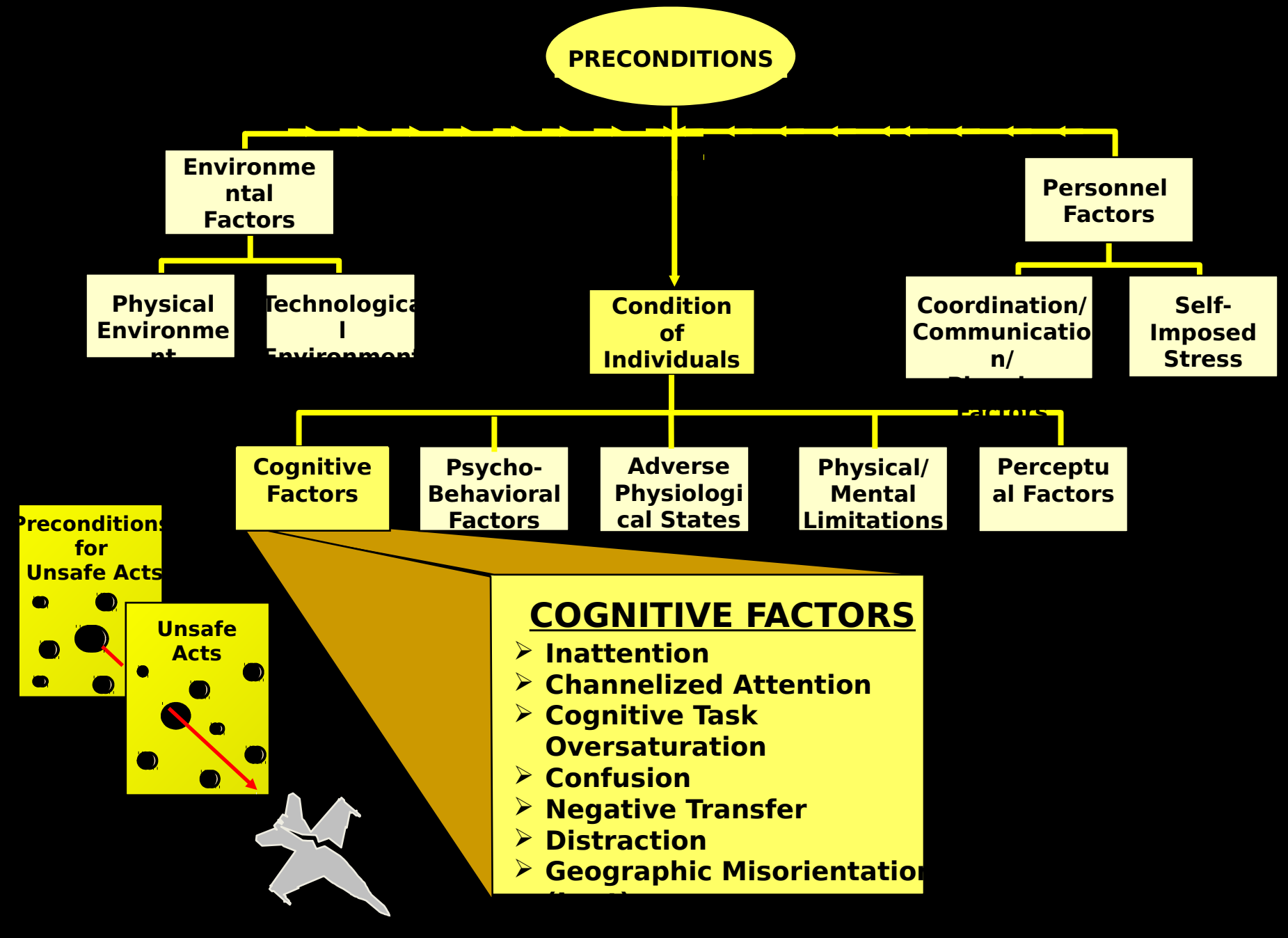
Unsafe Acts
SELF-IMPOSED STRESS
Alcohol
Physical Fitness
Drugs/Supplements/Self Medication
Nutrition
Inadequate Rest
Unreported Disqualifying Medical Condition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Unsafe Acts
COGNITIVE FACTORS
Inattention
Channelized Attention
Cognitive Task Oversaturation
Confusion
Negative Transfer
Distraction
Geographic Misorientation

PRECONDITIONS

Environmental Factors

Physical Environment

Technological Environment

Condition of Individuals

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Cognitive Factors

Psycho-Behavioral Factors

Adverse Physiological States

Physical/ Mental Limitations

Perceptual Factors

Preconditions for Unsafe Acts

Unsafe Acts

PSYCHO-BEHAVIORAL

- Personality Style
- Pre-Existing Personality Disorder
- Pre-Existing Psychological Disorder
- Emotional State
- Overconfidence
- Complacency

PRECONDITIONS

Environmental Factors

Physical Environment

Technological Environment

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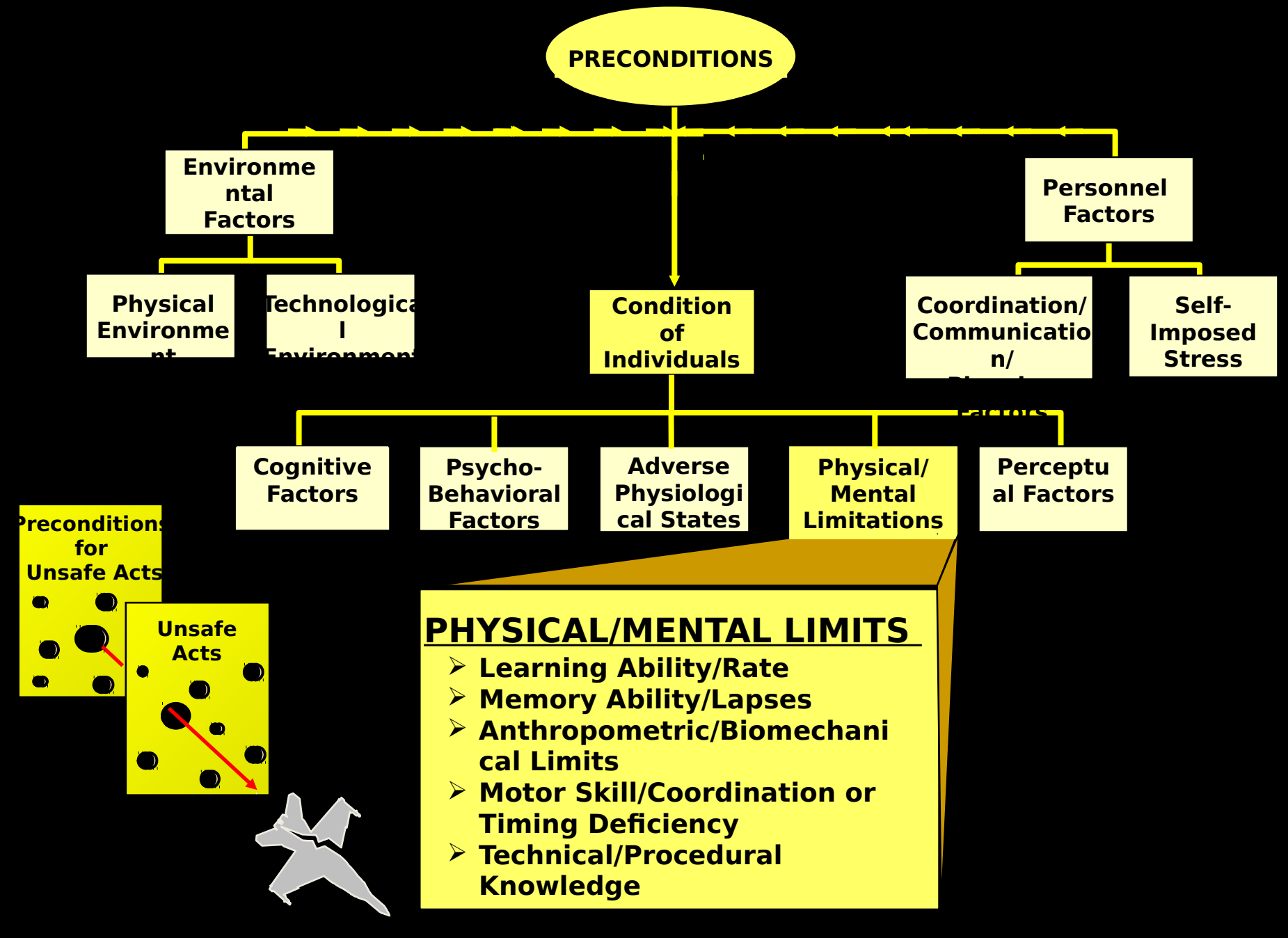
Preconditions for Unsafe Acts

Unsafe Acts

ADVERSE PHYSIOLOGICAL

- Effects of G Forces (G-LOC, etc)
- Physical Fatigue (Overexertion)
- Fatigue – Physiological/Mental
- Hypoxia
- Motion Sickness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Preconditions for Unsafe Acts
Unsafe Acts
PHYSICAL/MENTAL LIMITS
Learning Ability/Rate
Memory Ability/Lapses
Anthropometric/Biomechanical Limits
Motor Skill/Coordination or Timing Deficiency
Technical/Procedural Knowledge

PRECONDITIONS

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Technological Environment

Condition of Individuals

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Adverse Physiological States

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Perceptual Factors

Preconditions for Unsafe Acts

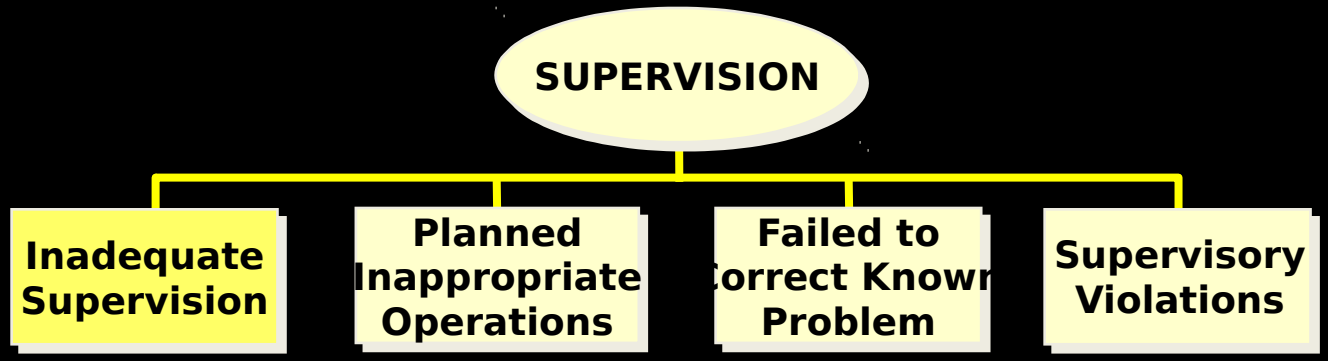
Unsafe Acts

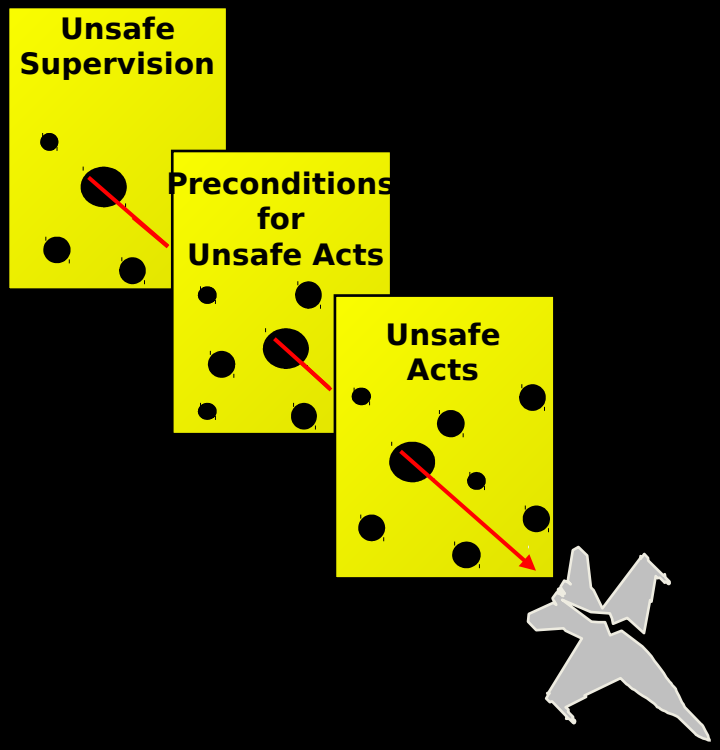
PERCEPTUAL FACTORS

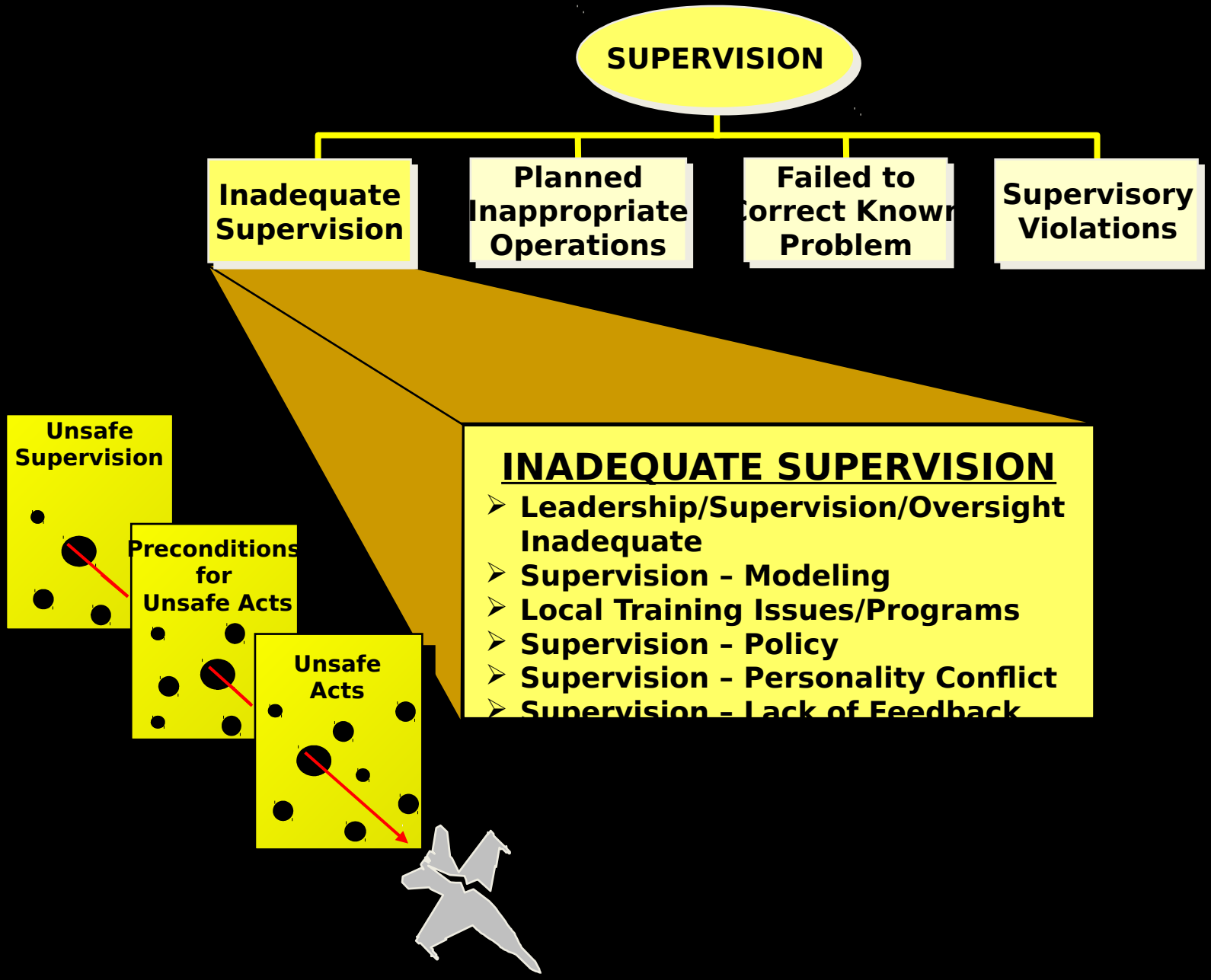
- Illusions: Kinesthetic/Vestibular/Visual
- Misperception of Operational Conditions
- Misinterpreted/Misread Instrument
- Expectancy
- Auditory Cues

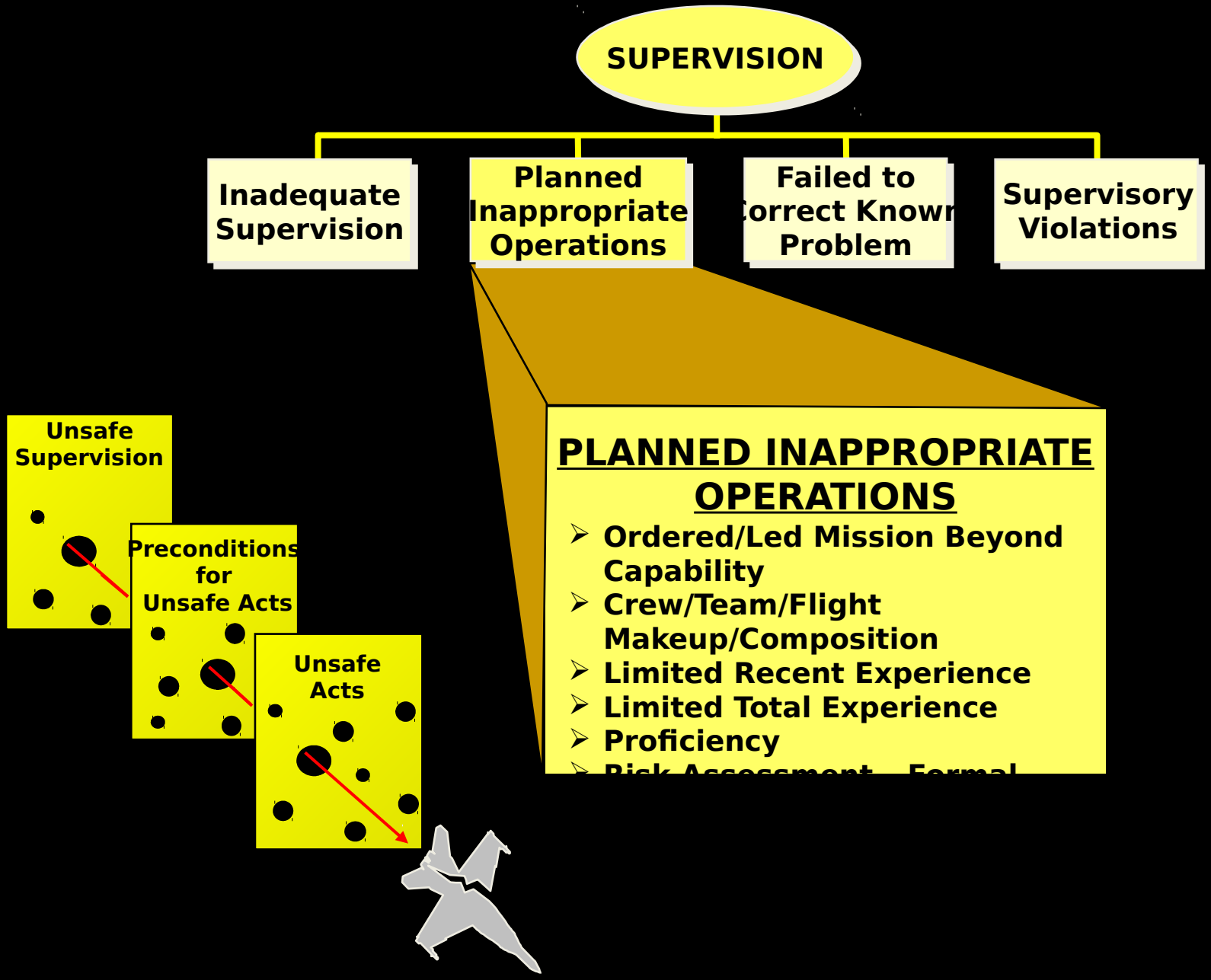
Supervision

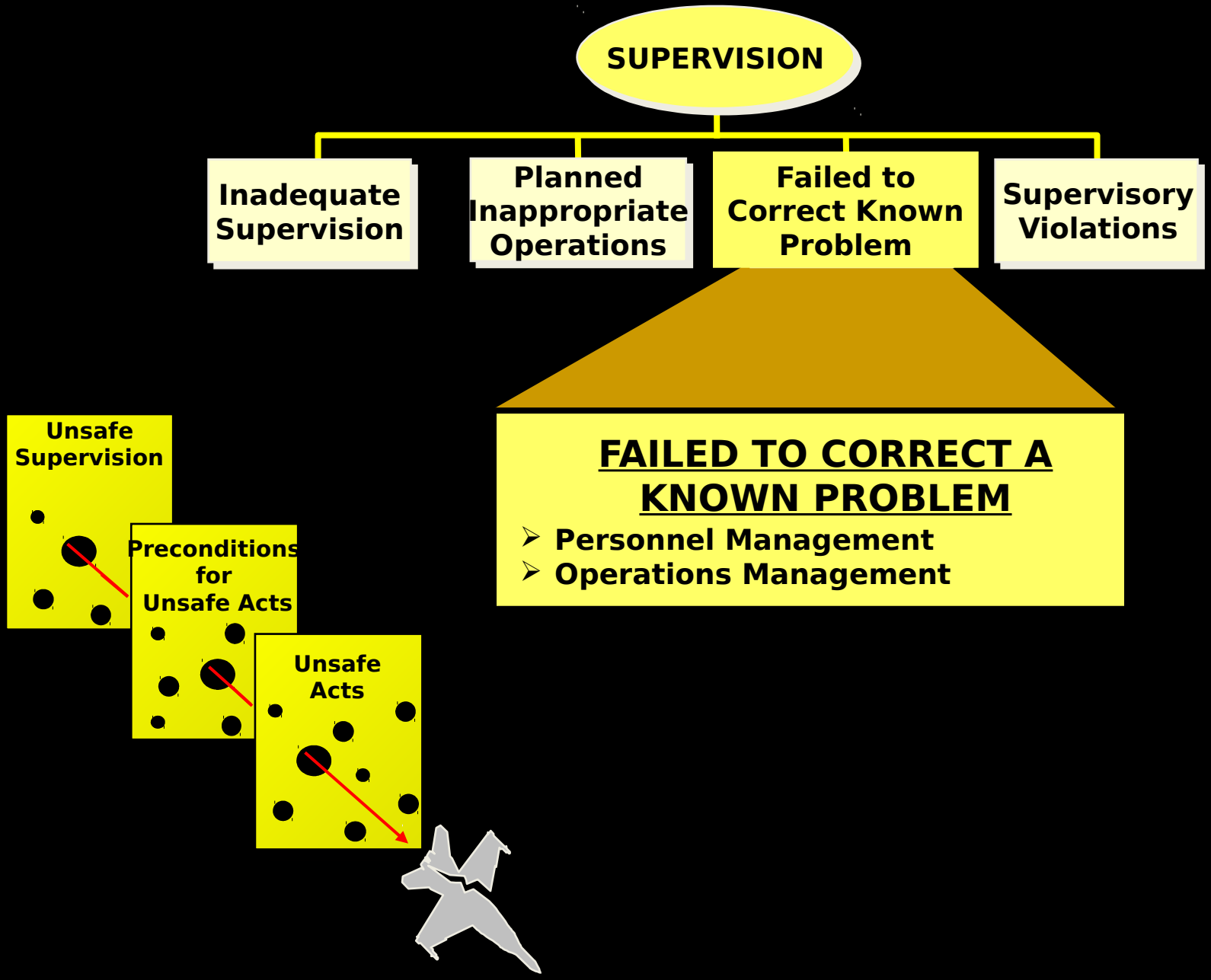
- Inadequate supervision: lack of guidance, written policy, or training opportunities
- Failure to correct known problem: problems with personnel or operations
- Inappropriate Operations: lack of proper risk assessment or assigned inappropriate personnel to task
- Violations: unnecessarily allows

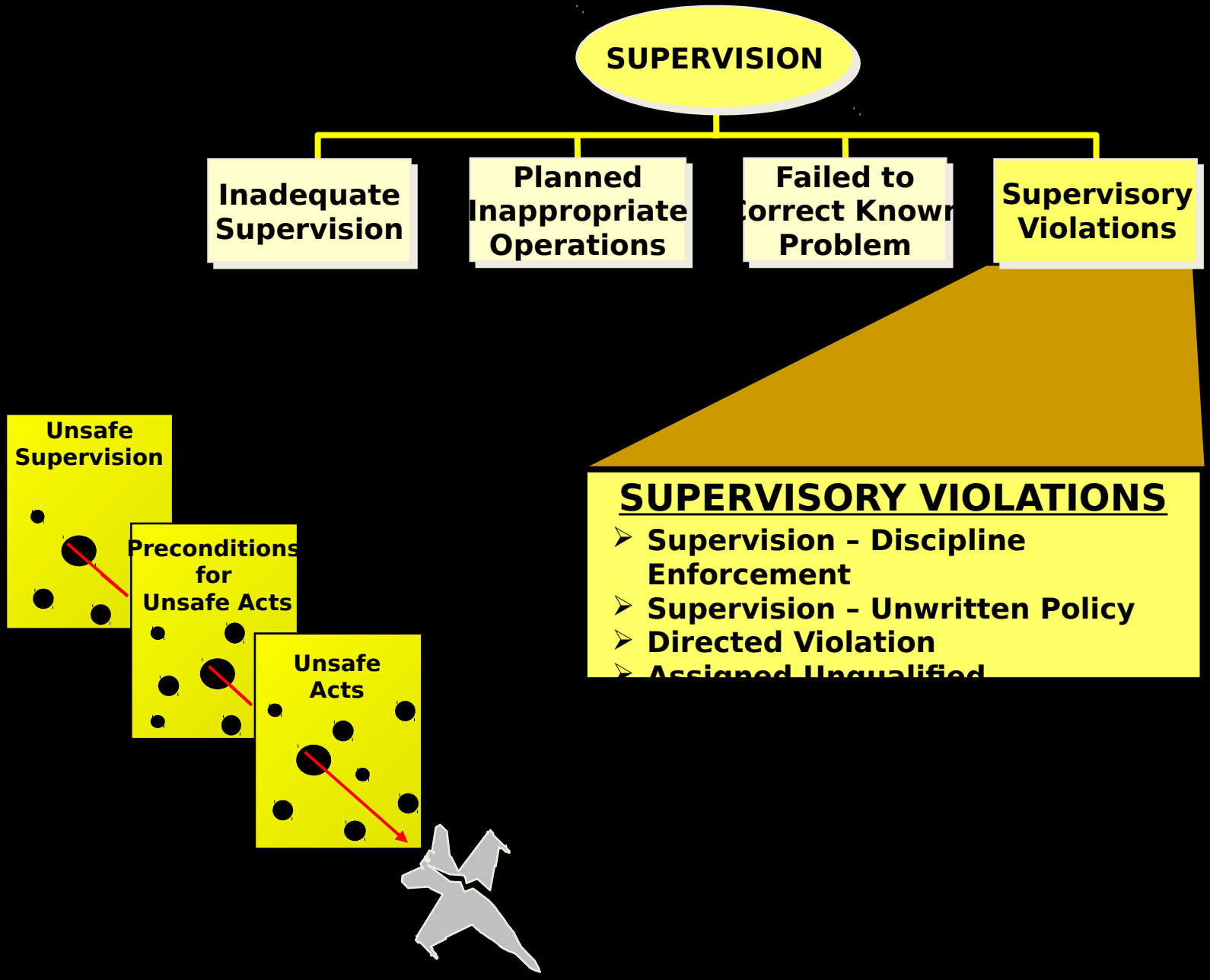

SUPERVISION
Inadequate Supervision
Planned Inappropriate Operations
Failed to Correct Known Problem
Supervisory Violations


Unsafe Supervision
Preconditions for Unsafe Acts
Unsafe Acts


SUPERVISION
Inadequate Supervision
Planned Inappropriate Operations
Failed to Correct Known Problem
Supervisory Violations
INADEQUATE SUPERVISION
Leadership/Supervision/Oversight Inadequate
Supervision – Modeling
Local Training Issues/Programs
Supervision – Policy
Supervision – Personality Conflict
Supervision – Lack of Feedback
Unsafe Supervision
Preconditions for Unsafe Acts
Unsafe Acts

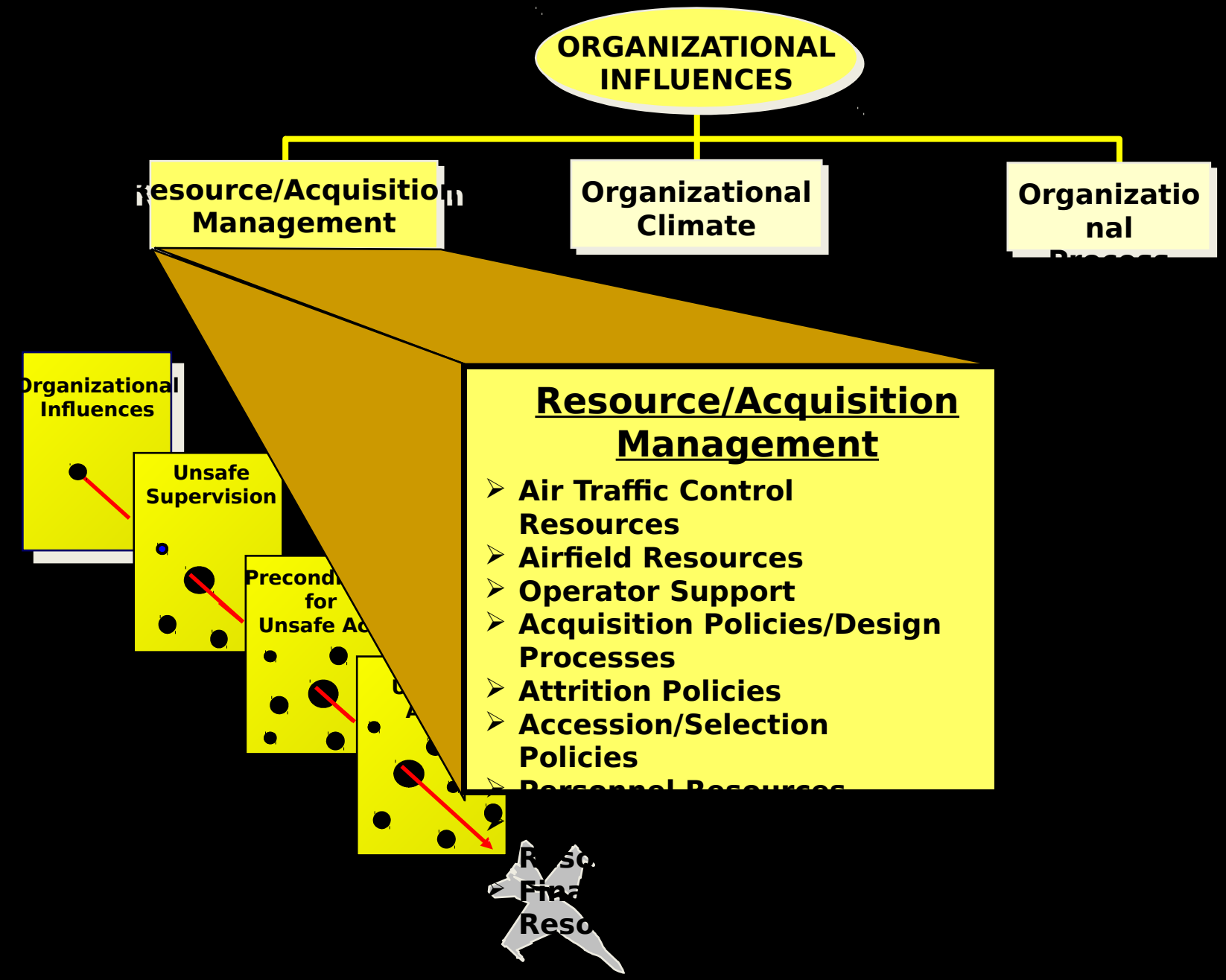

SUPERVISION
Inadequate Supervision
Planned Inappropriate Operations
Failed to Correct Known Problem
Supervisory Violations
PLANNED INAPPROPRIATE OPERATIONS
Ordered/Led Mission Beyond Capability
Crew/Team/Flight Makeup/Composition
Limited Recent Experience
Limited Total Experience
Proficiency
Unsafe Supervision
Preconditions for Unsafe Acts
Unsafe Acts

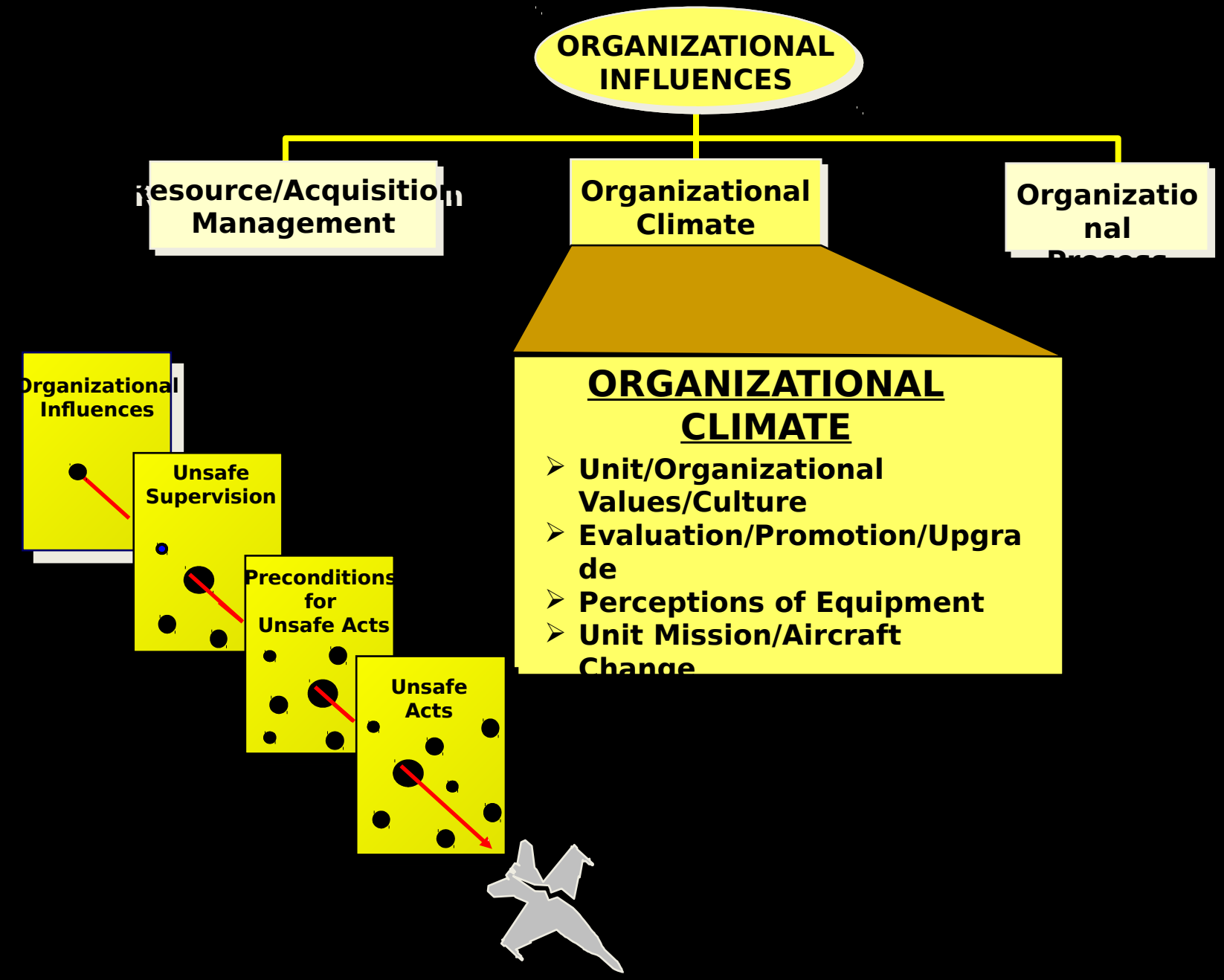

SUPERVISION
Inadequate Supervision
Planned Inappropriate Operations
Failed to Correct Known Problem
Supervisory Violations
FAILED TO CORRECT A KNOWN PROBLEM
Personnel Management
Operations Management
Unsafe Supervision
Preconditions for Unsafe Acts
Unsafe Acts

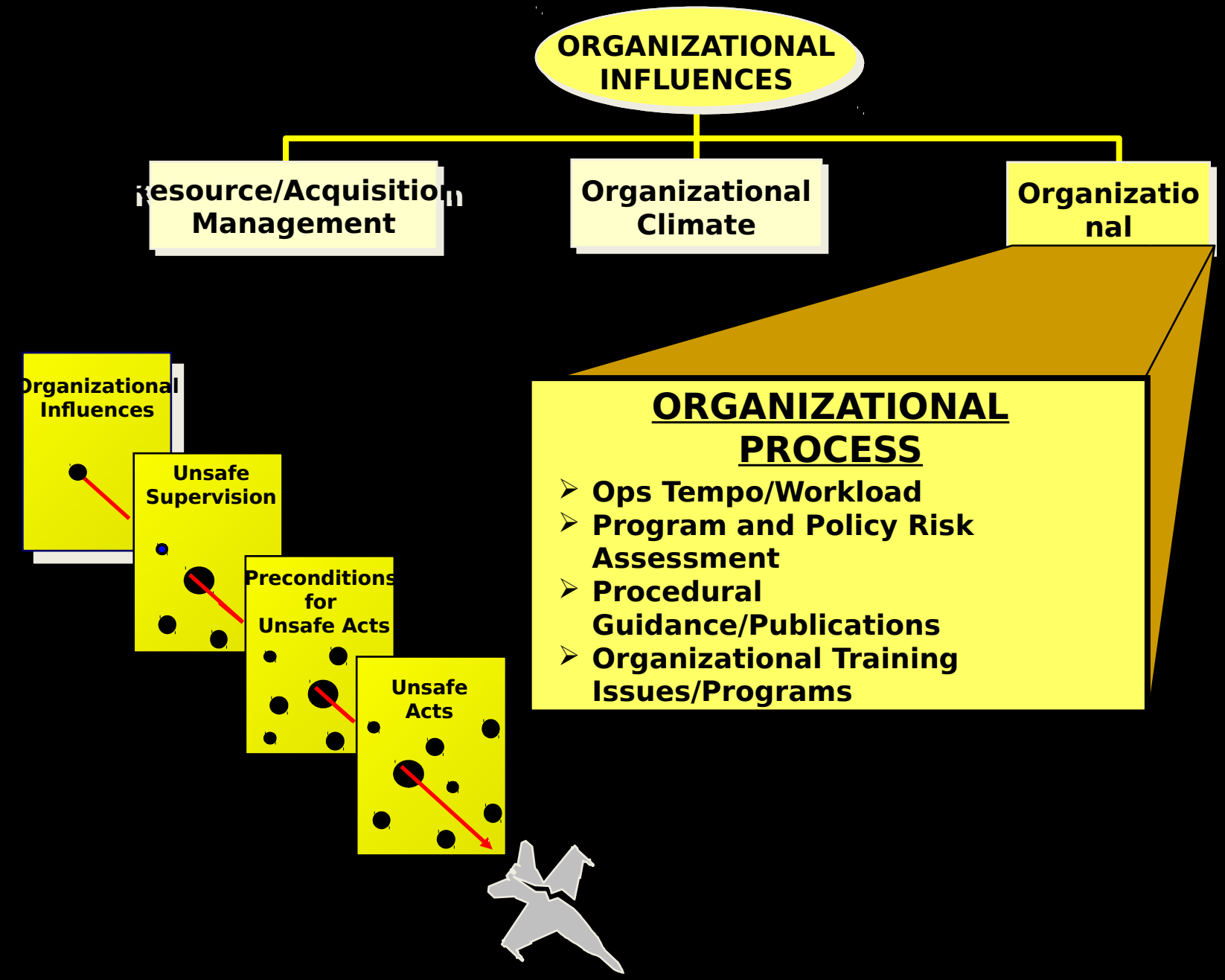

SUPERVISION
Inadequate Supervision
Planned Inappropriate Operations
Failed to Correct Known Problem
Supervisory Violations
SUPERVISORY VIOLATIONS
Supervision – Discipline Enforcement
Supervision – Unwritten Policy
Directed Violation
Assigned Unqualified
Unsafe Supervision
Preconditions for Unsafe Acts
Unsafe Acts

Organizational Factors

- Resource/Acquisition Management: the ways in which equipment is allocated
- Organizational Climate: affects morale in a unit
- Process: policies and procedures that drive the concept of operations


ORGANIZATIONAL INFLUENCES
esource/Acquisition Management
Organizational Climate
Organizatio nal
Organizational Influences
Unsafe Supervision
Precondi for Unsafe Ac
Resource/Acquisition Management
Air Traffic Control Resources
Airfield Resources
Operator Support
Acquisition Policies/Design Processes
Attrition Policies
Accession/Selection Policies


ORGANIZATIONAL INFLUENCES
esource/Acquisition Management
Organizational Climate
Organizatio nal
ORGANIZATIONAL CLIMATE
Unit/Organizational Values/Culture
Evaluation/Promotion/Upgra de
Perceptions of Equipment
Unit Mission/Aircraft Change
rganizational Influences
Unsafe Supervision
Preconditions for Unsafe Acts
Unsafe Acts


ORGANIZATIONAL INFLUENCES
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Organizational Influences
Unsafe Supervision
Preconditions for Unsafe Acts
Unsafe Acts
ORGANIZATIONAL PROCESS
Ops Tempo/Workload
Program and Policy Risk Assessment
Procedural Guidance/Publications
Organizational Training Issues/Programs

HFACS Example

H-60 enters out of control flight after loss of tail rotor authority. Aircraft becomes uncontrollable resulting in a hard landing and rollover. Engineering investigation reveals improperly installed tail-rotor mechanism pin.

DoD HFACS Coding

Act: Procedure performed incorrectly (AE103). Tail rotor cotter pin not correctly installed

Preconditions: warning systems (PE202). Lack of written warning for improperly installed pin

Supervisory: inadequate oversight (SI001). QA missed improper pin placement

Organizational: Informational resources (OR008). Lack of O-level diagram showing pin placement in relation to all other holes.

Flawed Doctrine (OP005). Army had solved the problem several years before. Info not made part of Navy maintenance.